WHITE PAPER

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To Col. Graham
Via ATC per 31 Jul request

PROPOSED APPROACH FOR ESTABLISHING AND UTILIZING A LOGISTICS MODELING/SIMULATION CAPABILITY FOR THE SDS

BACKGROUND

The Testing and Evaluation of the Strategic Defense System will be conducted through integrated modeling/simulation efforts within the NTB environment. Logistics analyses to be conducted during this process must consider critical parameters of system design (e.g., maintainability, producibility), system performance (e.g., reliability, availability), and system affordability (e.g., marginal costs, life cycle costs). Many of the logistics models and simulations needed to perform these analyses exist, or are currently being developed. The thoughtful integration and application of these models, directed by S/SE, in coordination with SDIO/TE, will provide the Community with the logistics analysis capability required to support the design and definition of a producible, supportable and affordable SDS.

The development of an integrated effectiveness/logistics modeling capability has been a major concern of the Logistics Modeling and Simulation Advisory Committee over the past 8 months. As such, a great deal of progress has been made in the up-front planning necessary to initiate this analysis capability within the NTB, although the nature of the Committee precludes its implementation of this plan. The technical approach summarized in the next section expands upon these pertinent Committee activities to propose a methodology for the implementation and utilization of an integrated modeling capability.

APPROACH

Throughout the T&E process, logistics analyses must be performed for two main reasons: (1) to "fine tune" the maintenance (as well as manufacturing and deployment) concepts for the SDS, and (2) to quantitatively assess the logistics impacts on the various proposed system architectures. In both cases, fundamental producibility, supportability and affordability (PSA) analyses must be conducted to address the broad spectrum of logistics issues that arise during RDT&E. The most efficient means of performing these analyses is the establishment of a two-level, coordinated effectiveness/PSA modeling capability within the NTB; these two capability levels can be labeled as the Interactive Modeling/Simulation Capability and the Integrated Modeling/Simulation Capability. The Interactive Modeling/Simulation Capability, designed primarily for supporting the maintenance/manufacturing concept development process, features the technical interactions of the logistics engineers and the "effectiveness" engineers during a dynamic model execution/analysis process. The Integrated Modeling/Simulation Capability is required to analyze subsystem design characteristics and is centered around an automated interface between selected logistics, [illegible] and engagement models/simulations. By implementing this dual-level approach, the selected set of available models can be used in the most efficient manner answering questions from the highest to the most detailed levels.

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The two levels of this proposed modeling/simulation capability are described in more detail below.

1. Interactive Modeling/Simulation Capability

Not all issues facing S/SE at this time are conducive to an analysis capability which contains an automated (i.e. transparent) interface between logistics and system effectiveness models/simulations. Instead, during the system design process, when major PSA issues are still unresolved, it is often more productive to independently exercise logistics models to develop maintenance/manufacturing concepts and perform top-level sensitivity studies. The results (output) of these PSA models/simulations are then merged with performance data and system specifications for input to engagement models/simulations. This first-level analysis capability for the NTB, illustrated in Figure 1, is a dynamic process where the logistics engineers and the "effectiveness" engineers conduct frequent technical discussions concerning concept definitions, the implications of proposed design modifications, and specific model inputs and outputs. The key to the successful implementation of this "engineers-in-the-loop" capability is the employment of system-knowledgeable logistics engineers who can communicate with the "effectiveness" engineers at a technical level, and who also possess a full understanding of the modeling process and the complex analyses that must be conducted during system RDT&E.

2. Integrated Modeling/Simulation Capability

Once a maintenance concept is fairly well-defined, automating the effectiveness/PSA model interaction process provides an effective means for performing more detailed analyses, such as determining the effect of subsystem-level modifications on overall availability, or making more accurate cost projections. The Integrated Modeling/Simulation Capability for the NTB, illustrated in Figure 2, incorporates a maintenance/manufacturing concept (evaluated via the Interactive Modeling/Simulation Capability) that is embedded into an integrated system effectiveness/producibility/supportability/affordability model. At this level, the "effectiveness" engineers and the logistics engineers are extensively involved in formulating inputs and analyzing outputs, but the interactions among models are performed automatically.

The first step in establishing this capability is the selection of a set of candidate effectiveness and PSA models/simulations. While it is not necessary for the models to be written in a common programming language, data links must be identified and module interfaces must be developed. The final integrated software product will be based on automated communication between effectiveness and PSA modules. The successful implementation of this challenging effort will clearly establish a credible logistics analysis capability within the NTB.

REQUIRED TASK AREAS

The establishment and utilization of a logistics modeling/simulation capability for the SDS will be accomplished through the execution of six major tasks. Each of these is briefly described below.

1. Identification and Integration of Databases, Models and Simulations. Relevant databases, models and simulations shall be identified and categorized according to their area/level of applicability. A selected hierarchy of available databases, models and simulations will be recommended for inclusion in the analysis

implementation effort based on their specific capabilities, verification/validation history, and applicability to the NTB environment. Subject to Government approval, the interfaces required for integrating this selected set of databases, models and simulations shall be specified in detail.

2. Integrated Plan for NTB Participation. A detailed plan of action and schedule for ensuring that S/SE analysis requirements are incorporated into the NTB environment in a complete and timely manner shall be established and implemented. This plan must be fully integrated with the NTB Program Office and the Test and Evaluation Directorate, as well as other cognizant SDI organizations. Other pertinent issues to be addressed include (but are not limited to) the configuration (hardware/software network) for accessing and interacting with the NTB computer network, data configuration management and security.

3. Test and Evaluation Plan Development. A comprehensive plan shall be developed for testing and evaluating the candidate logistics infrastructures within proposed system architectures. This plan must be coordinated with SDIO/TE and the Test and Evaluation Working Group. The plan must provide a fully-integrated approach for quantitatively and qualitatively analyzing the entire spectrum of logistics issues for the SDS. Critical parameters of interest, evaluation criteria, and the proposed involvement within the NTB environment must be detailed, with reference to the databases, models and simulations identified in Task 1 above.

4. Test and Evaluation Plan Implementation. Upon Government approval, the Test and Evaluation Plan shall be implemented. Intermediate results shall be compiled and reported to S/SE on a quarterly basis. A complete set of test results and corresponding evaluation(s) shall be documented in a Final Test Report.

5. Recommendations. Recommendations shall be provided to S/SE on a quarterly basis as a result of the findings during the implementation of the Test and Evaluation Plan. It is envisioned that an interactive process will be established whereby conclusions drawn from the implementation phase will result in recommended actions/modifications for other cognizant SDI groups. These actions would, in turn, result in further testing requirements as a part of this effort.

6. Participation in Relevant Working Groups/Committees. An up-to-date knowledge of the dynamic analysis requirements within SDIO shall be maintained through active participation in relevant Working Groups and Committees. At the present time, this participation must include attending meetings of the Test and Evaluation Working Group, Integrated Support Working Group, Logistics Modeling and Simulation Advisory Committee, and other pertinent committees as identified by the Government.

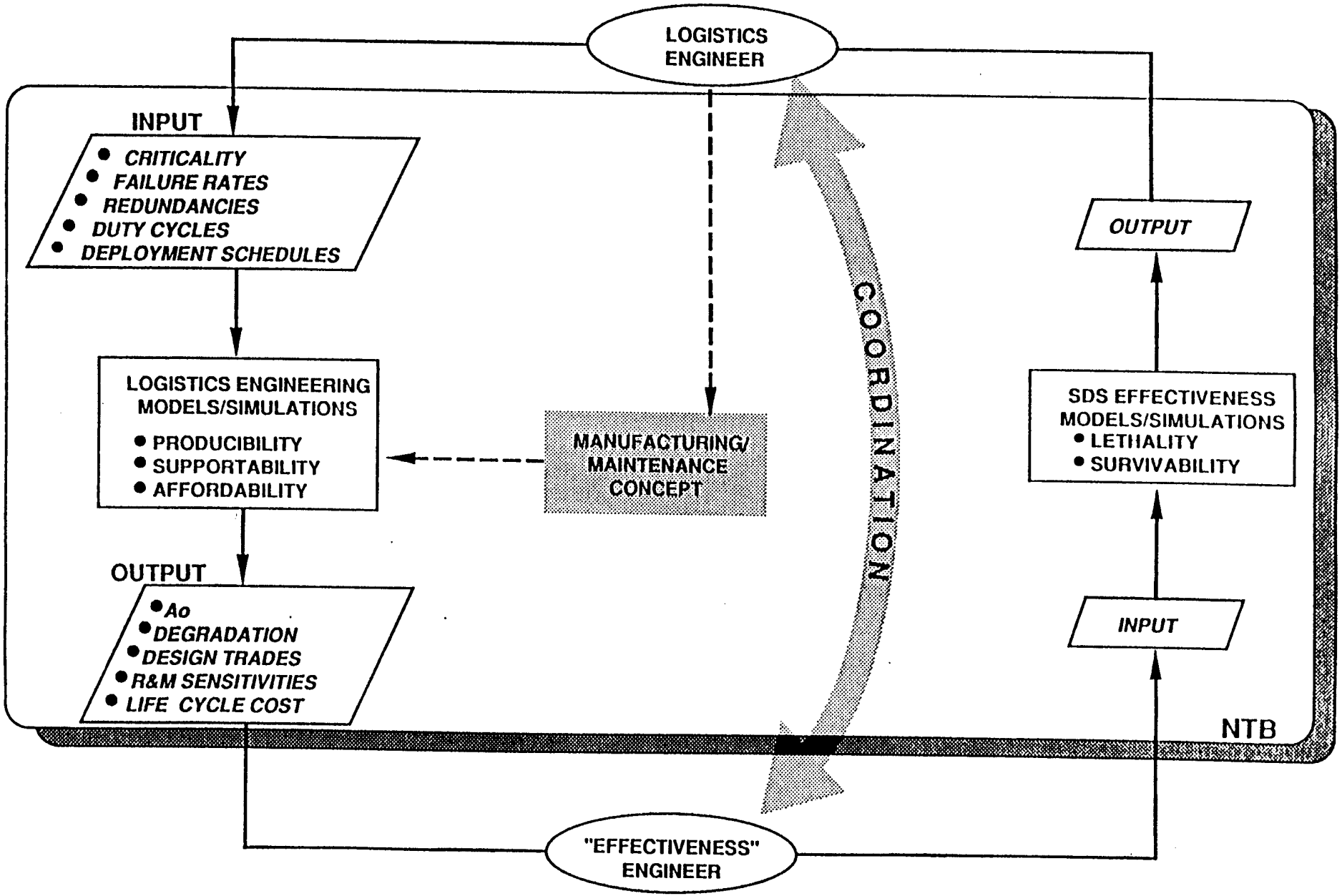

Figure 1 Interactive Modeling/Simulation Capability

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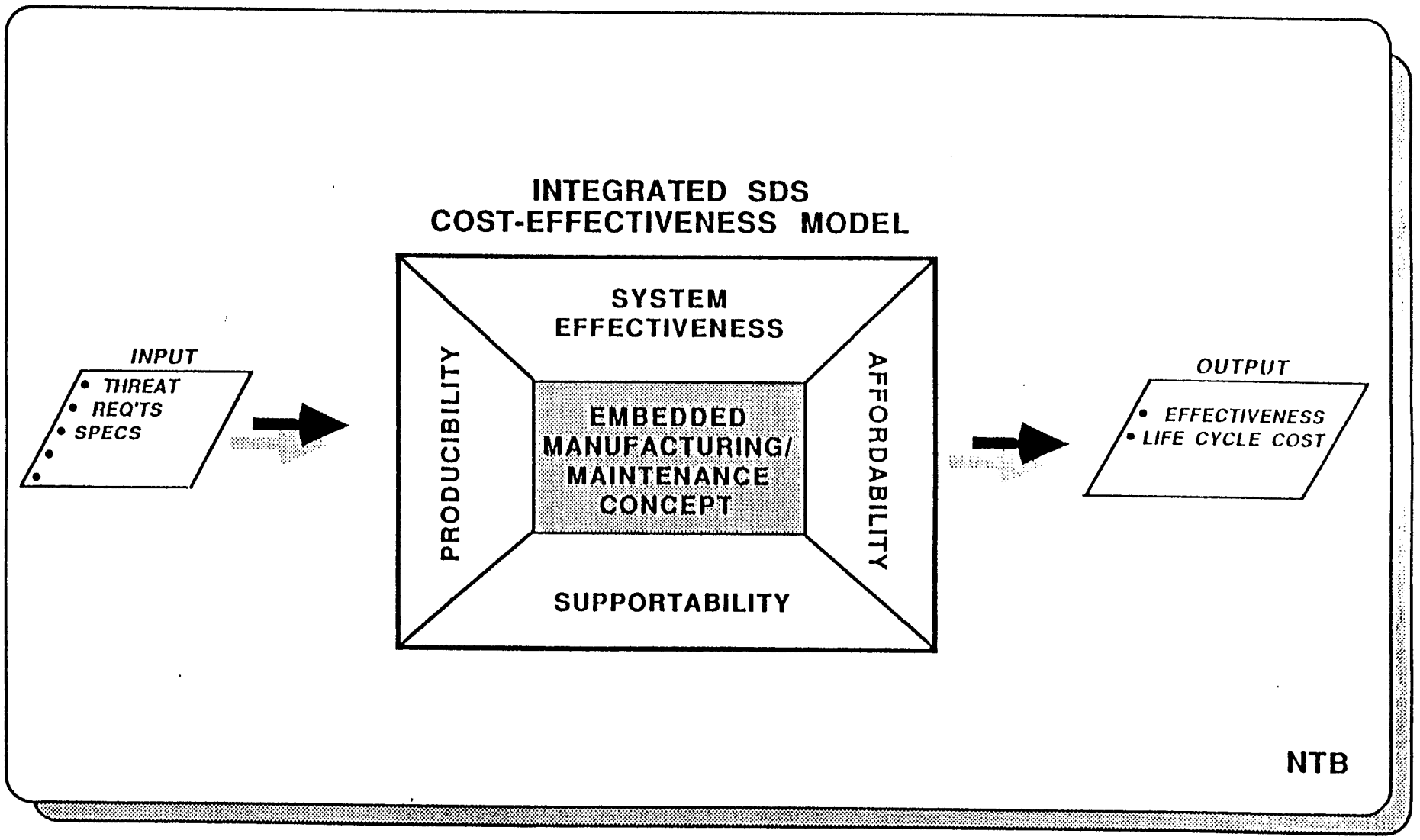

Figure 2 Integrated Modeling/Simulation Capability

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